Categorical Perception in French Sign Language

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Goals. While categorical perception (CP) has been documented in American Sign Language (ASL), the only French Sign Language (LSF) study did not find any effect. We use a new methodology to investigate CP in two major dimensions in LSF, namely handshape (HS) and place of articulation (POA). The study is currently in progress and is set to run until August. This abstract can thus be regarded as a preregistration of our study.

Background. Studies on CP in sign language show controversial results, some reporting an effect of CP, while others do not. This is partly explained by the fact that these studies adopt various experimental designs (see Table 1), thereby making comparison very challenging, as shown for CP in spoken languages (Gerrits and Schouten, 2004; Fujisaki and Kawashima, 1970).

Our study. We replicate in a more controlled way Emmorey et al.'s study on ASL in a new language, LSF. We largely follow the structure of the CP experiment described in that study while implementing new crucial adjustments to their design (see below). Additionally, for the first time in CP studies in sign language, reaction times (RT) will be recorded to test for differences across participants (Pisoni and Tash, 1974).
Materials: We created our avatar with *Poser Pro* (Bondware, v.11). To avoid any lexical effect in signers, the stimuli are static pseudo-signs based on existing signs. We created two 11-step continua per dimension: one phonemic continuum (based on existing contrast), and one allophonic continuum (no contrast) for both HS and POA (Fig.1).
Participants and procedure: At least 20 deaf native signers, and 20 hearing nonsigners will participate via the online experiment platform *Labvanced* (Finger et al., 2017) within a semi-supervised format. First participants are tested on HS, one week later on POA. Both phonemic and allophonic continua are counterbalanced across participants. In both sessions, participants start with the discrimination task followed by the identification task to control for any categorisation effect. Contrary to previous studies, the design of our discrimation task is an XAB task in which A and B are shown simultaneously rather than in sequence. The simultaneous presentation of the two extremes will allow us to tap more into the language component while avoiding spurious memory effects. The stimulus, X, is always equal to either A or B, which are presented in the two positions (left or right), with A and B always 2 steps apart along the continuum. The four possible combinations (AAB, ABA, BAB, BBA) are presented for each 9 pairings, two times (i.e. 72 trials). In the identification task, the two extremes of the continuum (steps 1 and 11) are presented for 4sec. (position left-right counterbalanced across participants), then each step of the continuum is presented randomly. The whole sequence is shown 8 times per participant (i.e. 88 trials to be categorized). The two designs are presented in Fig.2.

Hypotheses/Expected results. We expect to find a difference across participants: a CP effect in signers for phonemic pairs, but no CP at all in nonsigners. In signers, if there is a phonological implementation in sign language, we expect to observe a main effect in phonological contrast (allophonic vs. phonemic pairs) with no interaction. However, if an interaction is found, this would mean that CP affects the different phonological dimensions. In this case, due to the difference in sensitivity, we predict HS to have a higher strength than POA (as seen in Emmorey et al., 2003). If no CP effect is observed (regardless of the phonological dimension or the phonological contrast), then results would be in line with Boutora (2008), thus highlighting a potential difference in perception across sign languages (in this case LSF vs. ASL), or methodological issues. Additionally, we expect to find shorter RT in signers compared to nonsigners due to the visuo-gestural modality, and shorter RT in phonemic pairs compared to allophonic pairs in signers as it should tap in their phonological system.

Table 1: Summary of previous CP studies conducted in sign language.

	Newport & Supalla (1975) in Newport (1982)	**Emmorey et al. (2003)**	**Baker et al. (2005)**	**Morford et al. (2008)**	**Best et al. (2010)**	**Boutora (2008)**
Language	ASL	ASL	ASL	ASL	ASL	LSF
Parameter(s)	HS & POA	HS & POA	HS	HS	HS	HS
Participants	4 deaf signers	15 deaf native signers 17 hearing nonsigners	15 deaf native signers 15 hearing nonsigners	13 deaf native signers 13 deaf non-native signers 13 hearing L2 learners	10 deaf early signers 10 deaf non-native signers 10 hearing L2 learners 10 hearing nonsigners	25 deaf signers 23 hearing nonsigners
CP observed?	HS: no POA: no	HS: yes (in deaf signers) POA: no	No	No	No	No
Ident. task (I)	n.c.	X	X	XAB	AXB	AX
Discr. task (D)	ABX	ABX	AX	XAB	AXB	AX
Order presentation	I / D	D / I	D / I	I / D	D / I	I / D
Stimuli	Signs	Signs	Pseudo-signs	Signs	Pseudo-signs	hands
Dynamic / Static	Dynamic	Static	Static	Dynamic	Dynamic	Static
Person / Avatar	Person	Avatar	Person	Avatar	Person	Avatar
Duration stimuli	1000ms	A,B = 750ms X = 1000ms	1500ms	∼2000ms	∼400ms	500ms
ISI	1000ms	1000ms	2500ms	0ms	1000ms	300ms

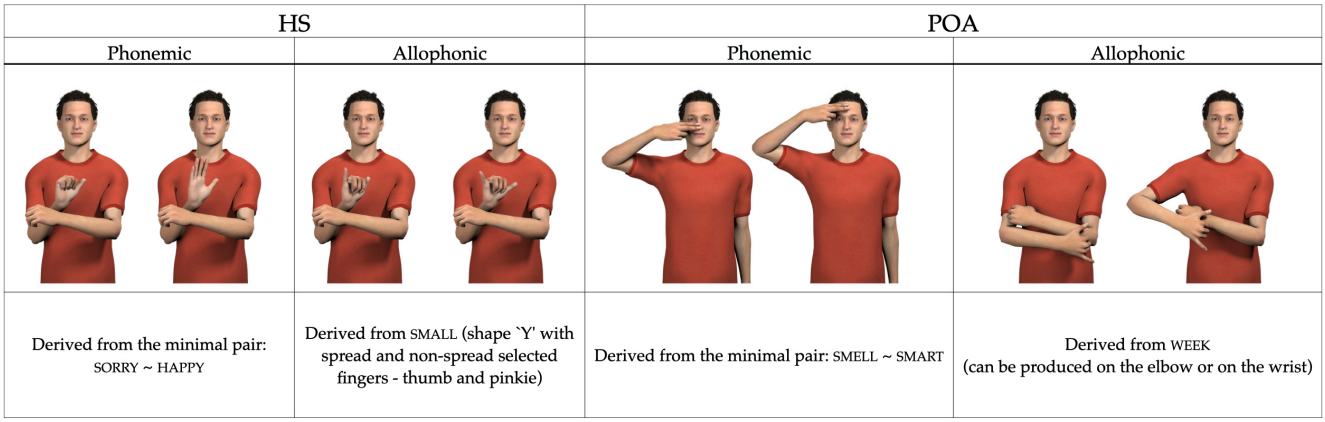

Figure 1: Extremes of the continua. Stimuli created with *Poser Pro* (Bondware, v.11) to generate a highly controlled continuum between two spatial positions (extremes) with linear interpolation, thus creating equal steps between the avatar's articulators.

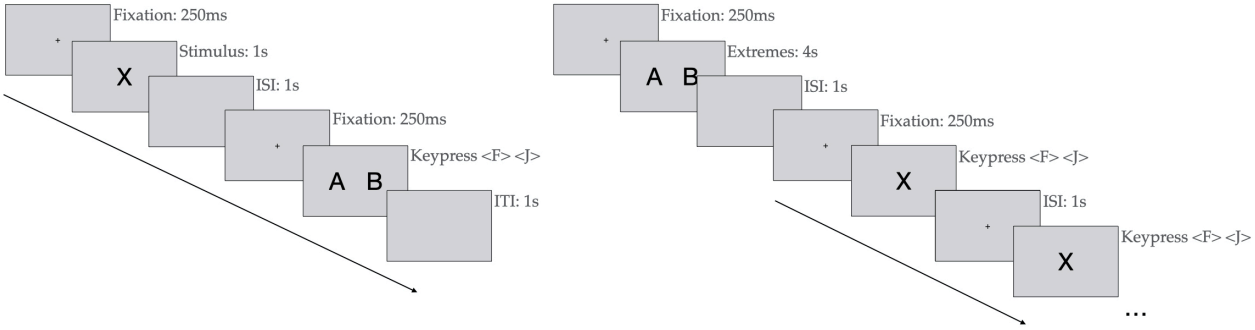

Figure 2: Design with durations: discrimination task (left) and identification task (right).

References.

Baker et al., Memory & cognition, 2005. **Best et al.** Attention, Perception, & Psychophysics, 2010. **Boutora**, Ph.D. dissertation, 2008. **Emmorey et al.**, Language and Cognitive Processes, 2003. **Finger et al.**, IC^{2}S^2, 2017. **Fujisaki & Kawashima**, J. Acoust. Soc. Am., 1970. **Gerrits & Schouten**, Perception & psychophysics, 2004. **Morford et al.**, Cognition, 2008. **Newport**, Language acquisition, CUP, 1982. **Pisoni**, Perception & psychophysics, 1974.